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SCIENCE

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THE FUTURE OF AGRICULTURAL EDUCATION AND RESEARCH IN THE UNITED STATES¹

EDUCATION and research in the interests of agriculture have become important factors in the daily thought and activities of this nation. Those of us who saw the beginnings of the great educational movement which had its inception during the Civil War now contemplate its magnitude and influence with a feeling akin to that of amazement. More than one hundred land grant colleges and agricultural experiment stations are now in active operation, which were manned under pre-war conditions by over 7,000 administrative officers, teachers and investigators, using a combined income of over twenty-five million dollars and instructing between forty and fifty thousand students, besides carrying on extensive lines of research. More than all this, as a by-product of the Land Grant Act of 1862, a great system of popular education has been organized and Farm Bureau agents and extension teachers are now in touch with a large majority of our farming people.

This new movement in education, generally spoken of as vocational, which was regarded in its earliest days as a dangerous innovation, has not only attained a remarkable development, but has without question exercised a modifying influence over the educational policy and methods of the older universities and colleges.

That these institutions have performed

¹ Vice-presidential address before Section M. American Association for the Advancement of Science.

an indispensable function in our educational system is now generally conceded. They are now firmly imbedded in our governmental policy and receive an almost unanimous support.

Notwithstanding all this we are now questioning concerning the future of agricultural education and research. Are these efforts so directed as to most fully serve public welfare? Will the ideals which have dominated them and the aims to which they have been directed in the past meet future needs? Do the shafts of ridicule, often directed at what has been termed mind culture, and the insistent assertion that education fails to meet modern needs unless it serves some practical end, proceed out of a sound philosophy? Maintained as these colleges and stations are under a popular form of government and subject to the reactions of political changes and the vagaries of the public mind, do we see any indications that their efficiency is menaced? Existing as they do, in what we sometimes fondly call a democracy, will education and research in the interest of agriculture develop the high standards of efficiency that are reached by privately endowed institutions?

The fact that the agencies in question have developed to great magnitude does not spell efficiency as directed to given ends. Efficiency in education and research depends largely upon factors not measurable in terms of extensive equipment, large faculties or great bodies of students.

The question of the permanency of the agricultural colleges and experiment stations need not arouse solicitude. The teachings of these institutions are too firmly embedded in agricultural thought and practise, and the rural people are too dependent in technical and difficult matters upon the body of knowledge that has been,

and is still being, developed, for their guidance to permit even a suggestion that agencies so useful will be allowed to lapse or lessen their activities. It must be conceded, too, that our experiences during the past two years have strengthened the confidence of the people in the colleges and stations. We can not fail to be impressed by the fact that a large number of men and women have been trained in these institutions to perform exactly the service now demanded in maintaining and directing our agricultural resources. It is gratifying to note also that many positions of responsibility in relation to food production and conservation are filled by graduates of the colleges of agriculture.

More than this, the large body of knowledge that has been collected and organized, which relates fundamentally to crop production and to the defense of the farmer and fruit-grower against the ills which beset them has greatly strengthened our grasp of the questions related to food production and conservation at a time when our resources are under a severe strain. Without these trained men and women and the knowledge gained through investigation and instruction in the interests of agriculture, it is difficult to understand how we could meet as successfully as we are doing the tremendous problems imposed by the war. We need not fear, then, that agricultural education will take a lesser place in our national life, but rather we may expect it to develop to meet larger needs, provided it is wisely directed.

The problem which should have our most careful thought and consideration is that of efficiency as related to the real functions which the colleges and stations should perform. As has been suggested, an elaborate physical equipment, generous endowments and subsidies, extensive laboratories and crowded classrooms—even

popular approval—do not of themselves indicate a wise educational policy. The great essentials of educational efficiency are intangible, and are found in the aims toward which the organization and activities of the colleges and stations are directed. In the case of state-supported institutions efficiency may also be promoted or hampered in a large measure by the conditions which are created through legislation and through the rules and regulations of related administrative departments, whether national or state.

Before proceeding further in our discussion, let us bring before our minds some of the essential purposes of agricultural education and research and the conditions that should be established within the institutions concerned, in order that this great national adventure in education, so generously endowed from public funds, shall not attain less than the largest possible results.

Without doubt, we can all agree to the statement that agricultural education and research should include in their scope fundamental purposes common to all education and research. No attempt at education in any direction is worthy of a place in our civilization which does not intensify in the individual a sense of his obligation to promote public welfare, elevate his moral and intellectual quality and in so doing enlarge his life opportunities and increase his efficiency for community service and individual attainment. No research is worthy of support that is superficial and trivial and in failing to arrive at fundamental truth and sound conclusions establishes an unsafe basis for practice. This means that agricultural education and research must be dominated by the ideals, infused with the spirit and strengthened by the conditions, that past experience has shown to be essential to the advancement of knowledge and to the training of young

men and women for the largest usefulness. The subject-matter and the tools of education and research may change, but the point of attack of the teacher and investigator should be the development of patriotic impulse, sound knowledge, elevated human character and individual efficiency and through these results promote human welfare. The influence of education is reflected chiefly in its product of truth and trained minds.

It is for these reasons that some of us hold that the great and insistent problems of the colleges of agriculture are not primarily related to institutional participation in the social and economic reorganization of rural communities, but are concerned first of all with the training of young men and women. It is a serious question whether these colleges have not expended energy and means in educational propaganda which could more wisely have been applied to increasing internal efficiency. There are many reasons for holding that community life will reach a sound and enduring social and economic status only when its progress is self-initiated and self-directed and possibly we shall some time discover that this very laudable impulse on the part of institutions to be of public service has been carried too far in attempting to impose rapidly upon the rural people conditions that can only be reached through that gradual education and development attained in no other way than through community effort.

The avenue through which agricultural education and research will react upon community life most effectively will not be elaborate platform and literary propaganda, but the continual personal contact of the people with minds adequately trained for leadership. If this be so, then the product of the colleges should be leaders. Do you say this is obvious? Grant-

ing that it is, we may now inquire as to the directions in which leadership is most needed.

When the land grant colleges first came into existence, the thought forced to the front, which has gripped the public mind ever since, was that agricultural education had for its function growing the extra blade of grass through the enlarged vocational efficiency of the farmer. Directed by this conception of its main purpose, the college of agriculture has in many instances been severely commercialized. Because of the changes that have arisen in our social and economic conditions and the increase of agencies established for the promotion of agricultural progress, the time has now come when we must ask the question whether the ultra-practical point of view so widely prevalent among agricultural teachers is the one that will fully meet the developing situation.

We are obliged to abandon the notion, if we ever held it, that these colleges will train within their walls any large proportion of the men and women that will live on the land. On the other hand, we must take practical cognizance of the fact that the by-products of the college, such as agriculture in the high schools, extension teaching and farm bureaus, are the agencies that are now touching farmers and farm homes in a more intimate way than was ever possible by the college and are accomplishing much that in earlier days the college was expected to do. There is now an unfilled demand for the highest type of leadership in these and other directions. This leadership, if it satisfies the demands that confront it, must be much more than merely technical and vocational. The future of the rural people is now greatly concerned with factors other than larger production.

It is increasingly evident that the social environment of the farm and the broad

economic conditions to which the farmer is now related, in the determination of which he must be a factor, must now receive major attention. It is not exaggeration to declare that the social organization of a rural community and the extent to which farmers successfully meet competing interests are now determinative factors in agricultural welfare and progress. The educational policy which is concerned chiefly with the problems of larger and cheaper crops will come far short of meeting the situation adequately. If these colleges of agriculture are to aid in developing men capable of the needed leadership, must they not lay the foundation in their graduates for the intelligent and successful consideration of the broad questions relating to rural sociology and economics? Should not these graduates become leaders of thought in all that pertains to community welfare and progress? The question then is, Do a majority of the colleges of agriculture adequately provide training of this type?

Having outlined a type of leadership now demanded for agricultural progress, we may now consider what should be the policy of the colleges of agriculture as related to the subject-matter of the courses of study and to the point of view established in the minds of the students through contact with their teachers. There has been more or less prevalent what some of us regard as a convenient fallacy, comforting, perhaps, to those who cater to popular notions as to what is practical in education, that a study of the sciences as applied to the various phases of agricultural practise and engaging the mind with such ultra-practical subjects as judging corn or cattle, making butter and cheese, orchard culture or poultry keeping, completes the round of the training essential to the agricultural college graduate and that in the interests

of vocational efficiency the severer ranges of thought involved in the study of the fundamental sciences, mathematics, economics, civics, psychology, language and literature should be reduced to a minimum. Can any one of us who has traveled the academic road and recalls the varying reactions upon his intellectual vision and equipment of the several subjects which engaged his attention as a student believe this is the needed training for such leadership as is demanded? Ask graduates from ultra-practical courses of study who have entered the service of a college or station, or who have attempted leadership in a rural community, how they regard this matter and you will get enlightenment from those whose experience justifies an opinion as to the adequacy of their undergraduate training. They will tell you, as many of them have told others, that they are called upon to enter into ranges of thought and to meet problems for which the college did not even lay the foundation of an adequate preparation.

Insistent questions arise just at this point. Can we reasonably speak of vocational efficiency or efficiency in any direction as apart from intellectual efficiency? Are technical expertness and practical facts a substitute for the development of the reasoning powers and the establishment of a sound basis on which to rest conclusions? For the future citizen, will the ability to judge a steer take the place of ability to judge a political candidate's civil and political theories? As a factor in the economic success of a rural community, will a knowledge of fertilizers take the place of wise plans for the disposal of the crops produced? For a human being whose life will be less than a success if he accomplishes nothing more than vocational prosperity and does not enter effectively into the problems of community welfare,

which is worth the most—ability to think clearly concerning human conduct and relations or mere expertness in farm management? Is anything a substitute for the development of high ideals of conduct and a clear understanding of human relations? In short, what are the major objects of human living and in what way can education serve these? Is the educational policy of our land grant colleges sufficiently directed toward the larger issues of life? Is it not entirely possible that the education provided at these institutions has become too material and commercial, and that we need to pause and consider whether vocational success without human efficiency is a result greatly to be desired? These are questions for serious thought and they now demand our attention.

If we accept the view, as obviously we must, that the mentality of a man or woman is a dominating factor in his or her human value and individual success, then we should carefully scrutinize the relation of the subject-matter of the college classroom to the development of intellectual acumen and vision. We may make a grievous error if we too fully abandon what is termed the cultural point of view in education and fail to nourish the intellect and to establish with our graduates a basis for correct and sound thinking regarding the broad relations of life. It will be a fatal error if we allow the demand for commercial advantage to cause us to ignore the need for soul and mind culture. Should we not, therefore, revert to some extent to the older and somewhat abandoned point of view held by the earlier educators that the function of the college is to establish with the student not so much a mass of facts as the ability to deal with facts?

Putting these questions in another form, we ask whether the ultra-practical course of study is not a mistake and whether the

college that retains to the largest possible degree an association with the fundamental sciences—those subjects traditionally spoken of as the “humanities”—especially those relating to social and economic conditions is not pursuing a wise policy? Some of us are convinced that conditions of expediency, based on popular demand, have led the agricultural colleges too far afield in what has been termed practical training.

At this point it may be asked, from whence shall come specialists for teaching and investigation in the fields of agronomy, agricultural biology, horticulture and animal husbandry if not from the agricultural colleges, and would not the injection into the curriculum of a larger proportion of the so-called general culture studies crowd out much that is essential to the technical courses and defeat, in part, the objects for which the colleges were created?

This question suggests others. In practice are the graduates from the prevalent agricultural courses found to be fitted to teach or investigate? Do they not soon discover, or at least, do we not discover for them, that the higher ranges of service, whether in the classroom, laboratory or in the field, demand broader and deeper vision than they possess, which must be acquired through a subsequent severer and more extensive training? Are we not in many instances turning to the graduates from the older universities for members of college faculties and station staffs? Why not then give to the student a broad educational foundation, with special attention to some line of science applied to agriculture and make him understand that to be a capable teacher, investigator, publicist, or even the most useful member of a rural community, all this and more is required. We should not be satisfied to bring into contact with our students or accept in our

station staffs men and women who are mere specialists and whose influence over the student's mind and in the station community ceases with imparting or gaining a knowledge of certain practical facts. Because the value to young men or women of their college experience arises to a great extent from their contact with teachers of broad vision, large understanding and an active sympathy with life problems, we should adequately prepare the teacher for this high function and great responsibility.

But you ask, what about the young men and women who go from the college to the farm and farm home? Considering the kind of service now demanded in rural communities, the need for leadership guided by the ability to reason from fundamental facts and principles and by an understanding of social and economic relations, is far greater than the need for mere expertness in fertilizing the land, feeding animals or spraying fruit trees, howsoever important these may be. For this reason let us train at least some young men and women to meet this need even if they must learn through postgraduate experience certain practical facts to which an ultra-practical course of study would give attention. To-day the human problems are the big problems. On its social and economic environment the future of the farm largely rests, and the average rural community sadly lacks leadership that is something more than vocational. In brief, then, the agricultural colleges should not establish entrance requirements and curricula chiefly with reference to turning out practitioners, but should give prominent consideration to training men and women for effective agricultural leadership. Such men and women, inspired by a zeal for service, are needed in our legislatures, even in our national legislature; they are needed as publicists and in close and constant

touch with the life of rural communities.

So far we have discussed some of the aims to which it is argued the agricultural college should direct its attention. Let us now consider the aims of the experiment station. If asked what they are, we might answer with the brief phrase—scientific research in the interests of agriculture. No answer is adequate, however, which does not include an interpretation of the term research. Should this interpretation be based upon the projects undertaken by experiment stations, we would surely arrive at a state of perplexity for it would include everything from severe laboratory inquiry to loosely conducted experiments having no possible outcome other than an answer to narrow business questions, possibly only local in their scope.

If the members of this Section now expect to hear a criticism of the past, they will be disappointed. It is much wiser to consider future efficiency, because in former discussions the mistakes of the past have been laid bare. Many of them were almost inevitable mistakes, incident to the rapid development of a new effort, especially under the coercive influence of public expectancy reacting upon legislative attitude. May we not, however, be permitted to indulge in criticism having a constructive purpose even though nothing new in the way of suggestion be offered.

The decision as to whether an alleged scientist is conducting research worthy of the name should depend upon the method or plan under which he is working and the quality of the effort applied to the problem and not upon the title of the project. An experiment station may state that it is studying problems of soil fertility, but if it is doing this merely by means of field experiments directed to determining the relative profit from different methods of culture without at the same time studying

as exhaustively as possible some one or more of the biological, chemical or physical factors contributing to the result but little or no real progress will be made. Our understanding of animal nutrition has not been the result of practical feeding experiments to any important extent but has developed out of studies of metabolism with the respiration apparatus and other refined methods. Instances of the futility of ultra-practical experiments as a means of arriving at basal facts and principles could be cited in great number.

One suggestion that reasonably applies to the whole range of agricultural research and which if followed more generally would undoubtedly result in greater investigational efficiency, is that experiment stations should confine their studies to the narrow individual factors that are involved in agricultural production rather than driving directly at broad generalizations or answers to business problems which include the operation of many factors. The history of agricultural science shows clearly that only in this way has substantial progress been made.

In discussing the efficiency of agricultural research in the United States our attention should not be confined wholly to the experiment stations but should also be directed to the largest single effort of this kind now supported by public funds. Doubtless what will now be said will be taken as a criticism and it is intended as such, not of individuals but of a situation which has grown up under what must be regarded as a mistaken policy. Reference is made to activities in the Federal Department of Agriculture classified as agricultural investigation that occupy the time of a large number of men and against which are charged annually millions of dollars of expense. While it is recognized that this department has made many

worthy contributions to agricultural science, it may safely be asserted that the conditions under which the scientific efforts of the department are conducted are not those which most fully inspire and nourish the research spirit or permit the most effective and economical application of time and energy to the study of problems. This is due to the fact that many of those persons who are expected to be fruitful in scientific results are so inextricably entangled with the distractions attending propaganda and administrative duties that the essential repose of mind, opportunity for study and reflection and continuity of effort, are not possible. The opinion is entertained by those familiar with the situation that until research efforts supported by, and maintained within, the Federal Department of Agriculture are separated from their present environment we may not expect the most efficient application of thought and energy to scientific studies.

So far we have dealt chiefly with questions of the internal policy of the agricultural colleges and experiment stations. Let us now turn to a consideration of the influence of certain external conditions of the nation and states.

A movement has developed during the past few decades which is of great significance to national and state-supported institutions and is regarded by those who have come under its domination as a menace to the efficiency of agricultural education and research. Reference is made to the marked tendency toward the centralization of directive authority over institutions maintained by public funds. It is evidently being assumed that greater efficiency and economy of energy and funds will result if upon the management of such institutions is superimposed through the authority of a department, bureau or commission, national or state, control that is essentially admin-

istrative in character. Evidently it is now assumed that it is more or less dangerous to leave with the management of certain national or state-supported institutions the liberty heretofore regarded as essential to successful administration, especially of education and research. In a few states where this movement is most marked, administrative officers have come to speak of themselves as "rubber stamps." The officers of certain of our colleges and stations surely must realize that they have lost their official autonomy to a considerable degree and that they should not be regarded as wholly responsible for the policy and conduct of the institutions over which they have charge. Is there any justification for this? Does it arise in the conviction that the colleges and stations have adopted wrong policies, employed incompetent men or wasted public funds? So far as can be discovered, it does not originate in charges of this nature.

Before discussing this situation in detail, let us outline what are the conditions essential to the successful direction and maintenance of education and scientific research. It is generally agreed that these are freedom of administrative initiative, such organization and relations as are stimulating both to the teacher and to the research worker and the possibility of maintaining a continuous policy in the conduct of any institution that is organized for the purposes named. A college or station must have a staff of workers, and its management should be at liberty to employ and develop this staff without let or hindrance within the limits of its financial resources. No regulations should be imposed which prevent the retention of satisfactory service on a salary basis consistent with the costs of living or which makes it impossible to meet in a reasonable way the competition for efficient teachers and in-

vestigators which is now so keen. These institutions must have funds, but they should be provided under regulations which do not constitute a barrier to the accomplishment of the ends for which they are established.

The relation of the federal government to the agricultural colleges and experiment stations which it is subsidizing has been the subject of much discussion and the occasion of more or less anxiety on the part of state officials. The congressional acts making possible the establishment of the land grant colleges, whether the first Morrill Act donating public lands to the several states or later acts making appropriations of money, placed few restrictions upon the several states accepting the terms of these acts. Each state has been allowed to organize and develop its college of agriculture without outside interference and while mistakes have been made and the expenditure of funds has been more or less wasteful, the result has been that these institutions have been developed and adjusted in accordance with the needs and conditions of the states in which they were located. It is probable that had the federal government attempted a centralized direction of this new enterprise the results would not have been as satisfactory as those which have been reached.

The original legislation establishing agricultural experiment stations and the acts subsequent thereto materially increased federal supervision. This is especially true of the terms under which the appropriations made by the Adams Act are applied to agricultural investigation. The Department of Agriculture requires not only that the various projects which the institutions propose to undertake shall be filed with the department for its approval, but it inspects the work and accounts of the several experiment stations to determine

whether the funds have been expended in accordance with the enabling act and solely for the study of the projects which have been filed. No fault can be reasonably found with the attitude of the federal government in ascertaining whether or not the money it appropriates is properly and legally expended, and there appears to be no disposition to chafe at the supervision now exercised by the national Department of Agriculture over the use of what are known as the Hatch and Adams Funds.

Later legislation, known as the Smith-Lever and the Smith-Hughes Acts, providing respectively for the extension of agricultural knowledge in a popular way among the people and for industrial education in our secondary schools, requires still closer supervision of the use of federal funds and of the plans proposed by the several states for the carrying out of these efforts. It is in these latter acts that federal supervision is regarded by many as having approached the danger point. This anxiety has been caused not so much by what is now the federal policy as by the future possibilities under the provisions of the acts named. It is felt that the direction of these educational efforts should have been confided more fully to the several states, other than a proper auditing of the expenditure of funds, and that too much leeway is given to the individual judgment of federal officials. There is certainly danger from more or less loosely defined directive authority that a governmental department or bureau may exercise, whether state or national, over education and research because our political system makes possible frequent changes in administrative staffs, and the maintenance of a consistent and uniform policy is thus endangered.

It is not intended in what is being said to criticize individuals, but to call atten-

tion to the dangers under our form of government of centralizing authority in departments or bureaus distantly located, and necessarily not closely informed concerning the institutions over which they may exercise supervision.

The situation in some of our states is an occasion for real alarm, for what is known as the budget system now threatens the efficiency of agricultural education and research. Undoubtedly such a system should be applied to the financing of the nation, the states, public utilities and even private enterprises, but a fiscal policy may be carried to such an extreme that it becomes burdensome and even tyrannical and defeats its own objects. To illustrate: in certain states legislative budget committees fix salaries for the various positions in the colleges and stations and establishes an expense budget for these institutions segregated into numerous items, and no deviation is allowed from either salary or expense items, no matter what exigencies may arise. As a rule, the members of these committees have no intimate knowledge of the operations of the institution with whose interests they are dealing and on the basis of a hasty judgment not fully informed may establish salaries and expense items in such a way as to greatly hamper institutional progress. It is absurd for a college president or the director of a station when taking on a new man at a low salary to be unable to give him any assurance that continued efficient service will result in improving his financial status. It is even more absurd if a call to go elsewhere is given to some member of a teaching or investigational staff for the president or director to be unable to retain his services when it would be economical and wise to do so by the addition of a few hundred dollars to his salary. It is perplexing,

sometimes embarrassing, and sometimes the occasion of vigorous language, for an institution to have its work set to a fixed financial scheme which does not fit the demands upon it. No prophets, ancient or modern, were ever called upon for a more difficult task than the filing of a statement with a legislative committee as to just how much money will be needed for traveling expenses twelve months in the future or how much it will cost to maintain a herd of cattle or run an automobile.

Those of you who are abiding in peace and comfort with a broadly segregated budget as, for instance, a lump sum for salaries and a lump sum for expenses, may think that these somewhat strenuous remarks concerning centralized control and an embarrassing bureaucracy are out of place. You should be assured, however, that this budget infection is spreading and that when one state adopts a new fiscal scheme other states are inclined to fall in line. Do not rest too quietly in your present liberty. The time may come when over yourself will be your board of control, and over your board of control a bureau, and over that bureau a committee, and over that committee the legislature, each division of authority feeling the responsibility of directing subordinate interests. There is every reason to fear that if present tendencies toward the closer control of our agricultural and research institutions by committees and bureaus is not checked, efficiency in education and research will abide only with privately endowed institutions.

WHITMAN H. JORDAN

SCIENTIFIC EVENTS
COMMITTEE ON THE BRITISH CHEMICAL
TRADE

THE committee appointed by the Minister of Reconstruction to advise as to the procedure which should be adopted for dealing with the